United States
Department of
Agriculture

Forest
Service

**Southwestern
Region**

**Forestry and
Forest Health**

May 2006

PR-R3-16-1

Forest Insect and Disease Conditions in the Southwestern Region, 2005

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Cover photo: Mixed conifer forests throughout the region experienced high levels of mortality in 2005.

Forest Insect and Disease Conditions in the Southwestern Region, 2005

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Conditions in Brief

With improved moisture in 2004 and throughout most of 2005, overall bark beetle activity continued to decrease region-wide. About 206,000 acres of conifer mortality were mapped in 2005, compared to 424,000 acres the previous year. Ponderosa pine, and especially piñon, mortality continued to decrease sharply in most of the region, while mortality in the higher elevation forests remained relatively high and increased in some areas.

Ponderosa pine mortality was attributed to western pine beetle (25,445 acres), *Ips* engraver beetles (6,900 acres), and roundheaded pine beetle (120 acres). Areas with the most damage in 2005 include the Gila National Forest, Fort Apache Reservation, and State and private lands in New Mexico. Areas most affected during the 2002-2003 drought—particularly in northern and central Arizona—experienced relatively little damage in 2005.

Higher elevation forests experienced mortality attributed to Douglas-fir beetle (77,255 acres), fir engraver beetle (63,550 acres), western balsam bark beetle (6,960 acres), and spruce beetle (19,935 acres). While significant outbreaks were detected throughout much of the region, the bulk of this damage occurred in New Mexico.

Piñon mortality was mapped on a total of 6,130 acres in 2005, the majority on Navajo and Zuni Tribal lands. Although detection surveys of the woodland type were limited in 2005, it was apparent that the massive, drought-related piñon ips outbreak of recent years had subsided in most affected areas. A notable upswing in piñon mortality was observed in the Zuni Mountains, an area that had largely escaped damage in previous years.

Western spruce budworm activity decreased somewhat in 2005, with 194,970 acres of defoliation detected; as usual, the primary focus was northern New Mexico. A Douglas-fir tussock moth outbreak on the west side of the Sandia Mountains remained active in 2005 and now encompasses 940 acres. New Mexico fir looper activity continued in the Sacramento Mountains of southern New Mexico, with 5,295 acres mapped in 2005. Spruce aphid activity was low in 2005, with only 185 acres of damage detected in the White Mountains of Arizona.

Aspen defoliation or dieback was detected on 83,225 acres, and was widely distributed across the region. In New Mexico, most damage was attributed to western tent caterpillars, while in Arizona much of the damage was a continuing problem related to past weather extremes, although an upswing in tent caterpillars was reported in some areas.

Dwarf mistletoes continue to have a major impact on growth and mortality of conifers in the Southwest. Over one-third of the ponderosa pine acreage and about one-half of mixed conifer acreage has some level of infection. Bark beetle activity is often related to dwarf mistletoe infection severity. The incidence of dwarf mistletoe changes little from year to year, but is thought to have increased over the past century.

Root diseases are widely distributed across the region, especially in higher-elevation forests. The most common, *Armillaria ostoyae*, and other root diseases increase tree mortality in all size classes and create hazard in heavily-used areas.

The incidence of white pine blister rust continues to increase in the Sacramento Mountains of southern New Mexico. Approximately 42 percent of white pines in this area are estimated to be infected with this often-fatal disease. Blister rust was detected for the first time on the Gila National Forest in 2005.

Table 1. Prominent 2005 forest insect and disease activity (acres) in Arizona and New Mexico.

Agent	State	National Forest	Tribal Lands	Other Federal	State & Private	Total
Western pine beetle	AZ	175	1,145	145	70	1,535
	NM	15,725	340	15	7,830	23,910
Ips beetle (ponderosa pine)	AZ	1,585	5,070	170	75	6,900
Ips beetle (piñon pine)	AZ	15	4,660		5	4,680
	NM	10	1,400		40	1,450
Douglas-fir beetle	AZ	14,700	6,420	60	30	21,210
	NM	33,635	4,285	395	17,730	56,045
Spruce beetle	AZ	855	1,505			2,360
	NM	10,440	1,135		6,000	17,575
True fir beetles	AZ	4,025	40		20	4,085
	NM	53,410	10,145	20	2,850	66,425
Western spruce budworm	AZ	870	10,335			11,205
	NM	141,785	2,770	45	39,165	183,765
Aspen defoliation	AZ	32,620	1,780	12,635	390	47,425
	NM	16,250	1,305	150	18,095	35,800
Drought effects on ponderosa pine	AZ	16,445			1,845	18,290
Root disease	AZ	219,000	**	**	**	219,000
	NM	860,000	**	**	**	860,000
Dwarf mistletoes	AZ	1,174,000	674,000	**	25,000	1,873,000
	NM	1,144,000	348,000	**	581,000	2,073,000

** Significant activity observed/known, but acreage not determined.

Table 2. 2005 Bark beetle incidence by site (in acres) from aerial detection surveys.

	Western Pine Beetle	Mountain Pine Beetle	Round-headed Pine Beetle	Ponderosa Ips	Piñon Ips	Douglas-fir Beetle	Spruce Beetle	True Fir Beetles	Bark Beetle Totals
Apache-Sitgreaves NFs	80			860	10	6,925	515	455	8,845
Coconino NF	70			315		4,410	340	2,270	7,405
Coronado NF			110			150		85	345
Kaibab NF	25			25	5	2,510		1,210	3,775
Prescott NF				105		130			235
Tonto NF				280		575		5	860
Grand Canyon NP	30			20		55			105
Chiricahua NM			10						10
Saguaro NM									0
Walnut Canyon NM						5			5
BLM	115			150					265
Fort Apache Tribal	110			4,910	10	460	1,140	30	6,660
Hualapai Tribal	900			5	10				915
Navajo Tribal	105			110	4,610	5,960	365	10	11,160
San Carlos Tribal	30			45					75
Hopi Tribal					25				25
Nav-Hopi JUA					5				5
State & Private	70			75	5	30		20	200
Arizona Total	**1,535**	**0**	**120**	**6,900**	**4,680**	**21,210**	**2,360**	**4,085**	**40,890**
Carson NF						11,885	6,605	7,640	26,130
Cibola NF	5					2,860	315	2,460	5,640
Gila NF	10,530					1,575		22,070	34,175
Lincoln NF	1,640					935	55	17,040	19,670
Santa Fe NF	3,545				10	14,770	3,465	4,200	25,990
Valles Caldera NP	5					1,610			1,615
BLM	15					180		20	215
Bandelier NM						215			215
Isleta Pueblo						50			50
Jemez Pueblo						100			100
Jicarilla Apache Tribal						2,800	550	15	3,365
Mescalero Apache	50						55	8,855	8,960
Other Tribal	290					110			400
Picuris Pueblo						125			125
Santa Clara Pueblo						785			785
Taos Pueblo						315	530	1,275	2,120
Zuni Pueblo					1,400				1,400
State & Private	7,830				40	17,730	6,000	2,850	34,450
New Mexico Total	**23,910**	**0**	**0**	**0**	**1,450**	**56,045**	**17,575**	**66,425**	**165,405**
SW Region Total	**25,445**	**0**	**120**	**6,900**	**6,130**	**77,255**	**19,935**	**70,510**	**206,295**

Table 3. 2005 Defoliation incidence by site (in acres) from aerial detection surveys.

	Western Spruce Budworm	Spruce Aphid	Aspen Damage	NM Fir Looper	Needle Cast	Douglas-fir Tussock Moth	Drought	Defoliation Total
Apache-Sitgreaves NFs	870	50	3,035					3,955
Coconino NF			6,850				11,960	18,810
Coronado NF			45					45
Kaibab NF			22,665				2,990	25,655
Prescott NF			15				220	235
Tonto NF			10				1,275	1,285
Grand Canyon NP			12,635					12,635
Chiricahua NM								0
Saguaro NM								0
Walnut Canyon NM								0
BLM								0
Fort Apache Tribal		135	1,190					1,325
Hualapai Tribal								0
Navajo Tribal	10,335		590					10,925
San Carlos Tribal								0
Hopi Tribal								0
Nav-Hopi JUA								0
State & Private			390				1,845	2,235
Arizona Total	**11,205**	**185**	**47,425**	**0**	**0**	**0**	**18,290**	**77,105**
Carson NF	80,265		8,525					88,790
Cibola NF	255		1,435			870		2,560
Gila NF	55		2,210					2,265
Lincoln NF			505	5,295				5,800
Santa Fe NF	54,790		3,285					58,075
Valles Caldera NP	6,420		290					6,710
BLM	45							45
Bandelier NM			150					150
Isleta Pueblo								0
Jemez Pueblo	10							10
Jicarilla Apache Tribal			10					10
Mescalero Apache	125		20					145
Other Tribal								0
Picuris Pueblo	70							70
Santa Clara Pueblo								0
Taos Pueblo	2,565		1,275					3,840
Zuni Pueblo								0
State & Private	39,165		18,095					57,260
New Mexico Total	**183,765**	**0**	**35,800**	**5,295**	**0**	**870**	**0**	**225,730**
SW Region Total	**194,970**	**185**	**83,225**	**5,295**	**0**	**870**	**18,290**	**302,835**

Status of Insects

Bark Beetles

Nearly all tree mortality mapped during aerial survey is attributed to bark beetles. While bark beetles are the primary tree killers in the region, mortality is most often a result of multiple factors, which may include disease, and especially drought. An additional consideration in interpreting aerial survey results is that acreages reported represent areas where significant tree mortality occurred. The proportion of host trees actually killed within each area (polygon) varies from site to site.

Several different bark beetles attack ponderosa pine in the Southwest. In recent years, most of the pine mortality in Arizona has been attributed to ips engraver beetles; in New Mexico, western pine beetle. Since both ips and western pine beetle (and others, including roundheaded pine beetle) are often active in the same area (and frequently attack the same tree), the "mortality agent" attributed to a particular area may be a matter of interpretation.

In the mixed conifer and spruce-fir forest types, distinguishing host trees (and hence, the particular beetle) can be difficult during aerial surveys. The accuracy of our determinations may vary—both from area to area and year to year—and are influenced by how much ground checking was accomplished. While we expect that the overall trends displayed for particular bark beetles are meaningful, some year-to-year fluctuations reflect differences in attribution.

Narratives below describe overall conditions and trends; site and landowner information is summarized in Tables 1 and 2. For the first time, we include damage summaries and recent trends for the major forest types.

Western Pine Beetle

Dendroctonus brevicomis
Primary host: Ponderosa pine

Tree mortality attributed to this insect decreased regionwide in 2005, with about 25,000 acres affected vs. 58,000 acres in 2004. As in recent years, most of the reported activity occurred in New Mexico. The Gila National Forest again had largest share of the damage (10,530 acres), although this represents a considerable decrease from levels reported there in 2004 (35,375 acres). A slight increase in activity was reported on State and private lands in New Mexico, where about 7,800 acres were affected.

In Arizona, the largest reported concentration of western pine beetle activity was on Hualapai tribal lands (900 acres). Note that this insect was probably more widespread in Arizona than reported in Tables 1 and 2, since it often attacks ponderosa pine initially attacked by ips engraver beetles.

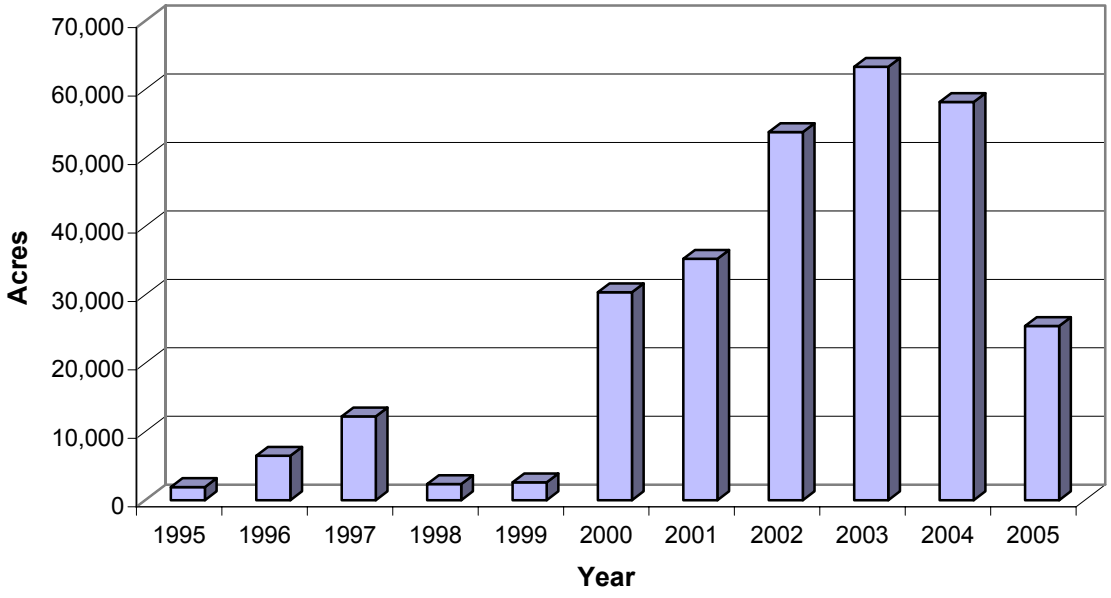

Figure 1. Western pine beetle activity in Arizona and New Mexico, 1995 – 2005.

Mountain Pine Beetle

Dendroctonus ponderosae
Primary hosts: Ponderosa, limber and bristlecone pine

No mountain pine beetle activity was detected in the region in 2005. Activity in previous years has mostly been limited to the Kaibab Plateau in northern Arizona, although limited activity (affecting limber pine) has been observed from the ground on the San Francisco Peaks and Kendrick Mountain near Flagstaff. Damage previously attributed to mountain pine beetle in northern New Mexico—and included in Figure 2 below—was later confirmed to be a result of western pine beetle.

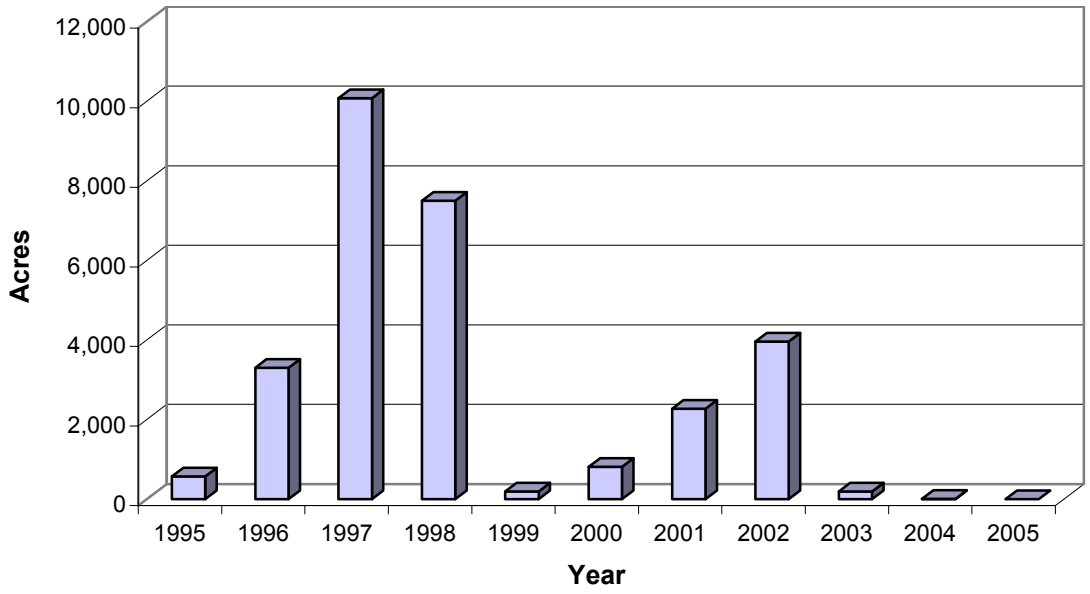

Figure 2. Mountain pine beetle activity in Arizona and New Mexico, 1995 – 2005.

Roundheaded Pine Beetle

Dendroctonus adjunctus
Primary host: Ponderosa pine

Tree mortality attributed to this insect continued to decline since a spike in 2002, with only 120 acres affected compared to 525 acres the previous year. As in 2004, all the reported 2005 activity occurred on the Coronado National Forest and the Chiricahua National Monument in southeastern Arizona. Roundheaded pine beetle has a fairly wide distribution in the region, is often associated with other bark beetles, and may be active in areas where mortality is attributed to other species. In previous years, the largest outbreaks have occurred in the Sacramento Mountains of southern New Mexico.

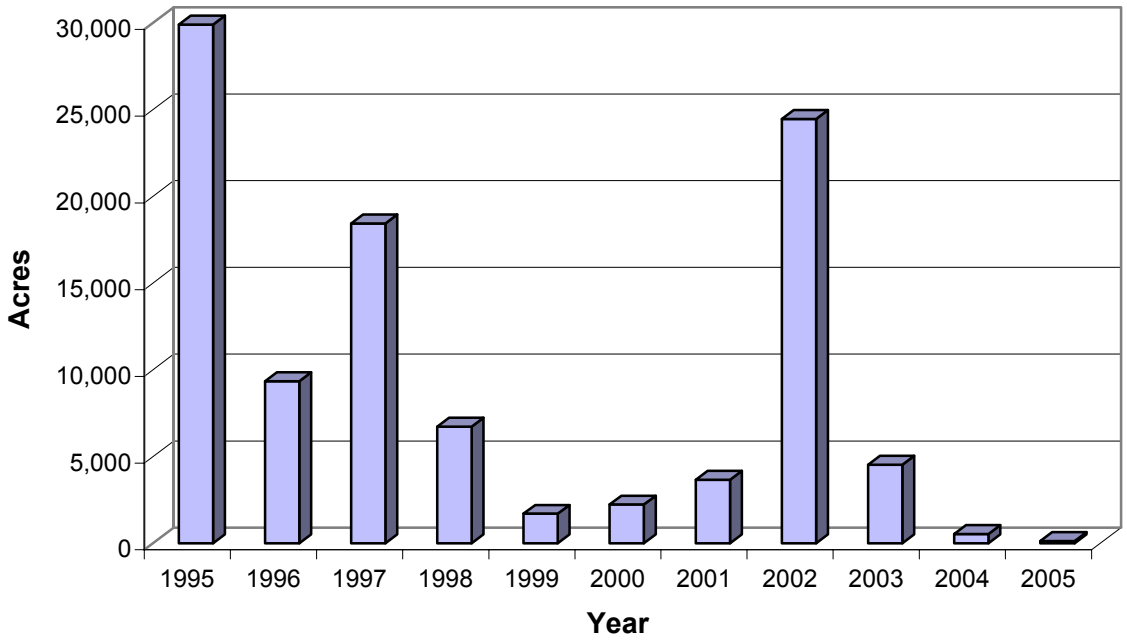

Figure 3. Roundheaded pine beetle activity in Arizona and New Mexico, 1995 – 2005.

Ips Beetles

Ips spp.
Primary hosts: Ponderosa pine, piñon pine

Ponderosa pine mortality attributed to *Ips* beetles continued to plummet following the very high levels observed (primarily in Arizona) in 2002 and 2003. Regionwide, activity was detected on about 6,900 acres in 2005, compared to almost 85,000 acres in 2004 and nearly 700,000 acres in 2003. All reported 2005 acreage occurs in Arizona, with the majority on the Fort Apache Indian Reservation (4,910 acres). Although no *Ips* damage was reported on ponderosa pine in New Mexico in 2005, *Ips* beetles, especially *I. pini,* are frequently associated with *Dendroctonus* throughout the state.

In recent years, several species of *Ips* have been found attacking ponderosa pine in Arizona, including *I. lecontei*, *I. pini*, *I. calligraphus*, *I. latidens*, *I. knausi,* and *I. integer*. Frequently, multiple *Ips* species have been identified from a single infested tree and/or in combination with western pine beetle and other *Dendroctonus* species.

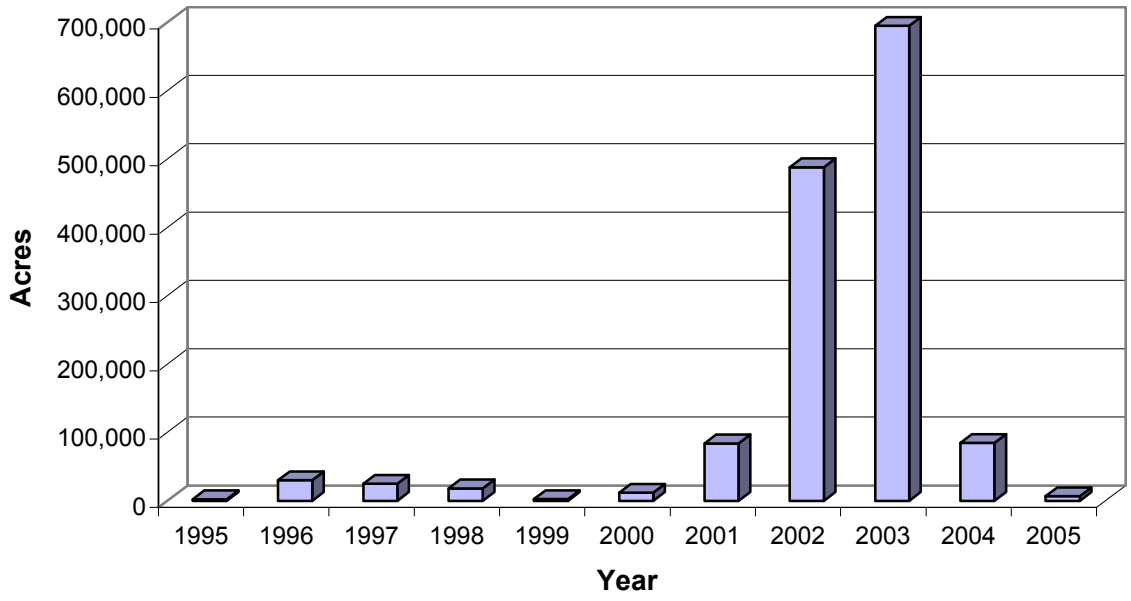

Figure 4. *Ips* beetle activity in ponderosa pine in Arizona and New Mexico, 1995 – 2005.

Piñon mortality, caused primarily by *Ips confusus,* was detected on only about 6,000 acres in 2005, with the majority on Navajo and Zuni tribal lands. Although only limited portions of the woodlands were flown, it was apparent that the massive, drought-related outbreak of recent years had subsided in most affected areas. A notable upswing in piñon mortality was observed in the Zuni Mountains of west-central New Mexico in 2005, an area that had largely escaped damage in previous years.

Note that during the recent piñon ips outbreak, sizable areas in both states experienced > 90 % mortality of the mature piñon. Nonetheless, it was apparent that factor(s) other than lack of host material were primarily responsible for the collapse of the outbreak, at least in many areas.

Douglas-fir Beetle

Dendroctonus pseudotsugae
Host: Douglas-fir

Douglas-fir beetle activity remained relatively high in 2005, with significant outbreaks continuing at many locations in both Arizona and New Mexico. Reported activity encompassed about 77,000 acres region-wide compared to 88,000 acres in 2004. As in 2004, northern New Mexico had the most extensive damage.

Note that while Douglas-fir mortality is generally attributed to Douglas-fir beetle, other agents including dwarf mistletoe, armillaria root disease, Douglas-fir engraver (*Scolytus monticolae)*, and Douglas-fir pole beetle (*Pseudohylesinus nebulosus*) may also contribute significantly on some sites.

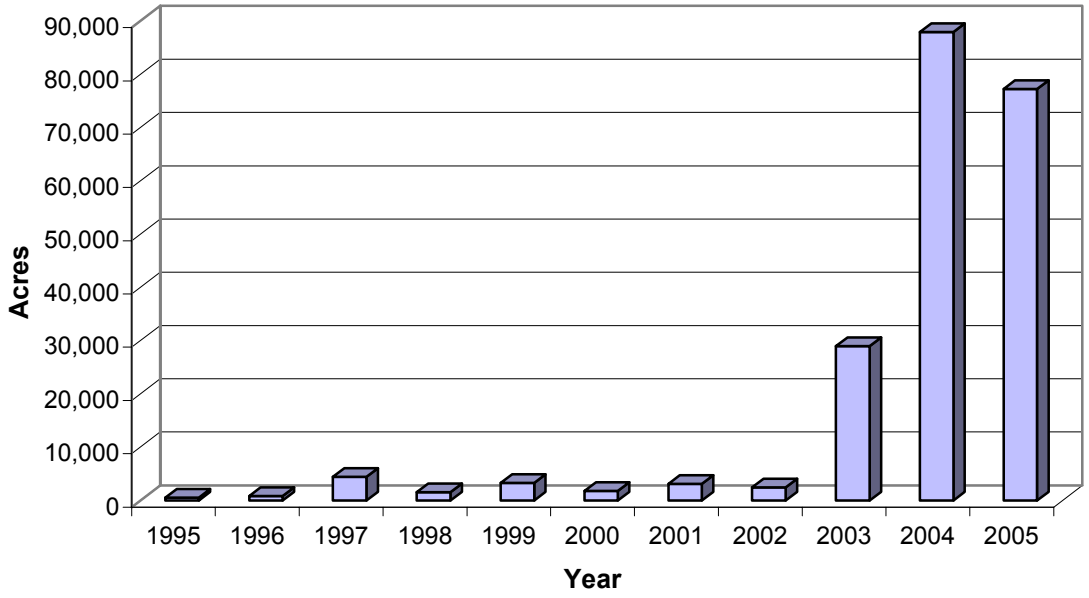

Figure 5. Douglas-fir beetle activity in Arizona and New Mexico, 1995 – 2005.

True Fir Beetles

For several years, we have reported damage from fir-engraver beetle (affecting white fir) and western balsam bark beetle (affecting corkbark fir) together, and have not always distinguished them during aerial surveys. Because of increased levels of damage in the higher-elevation forests, especially the past 2 years, we used forest type maps to derive separate damage estimates for these two beetle/host combinations. Mortality of true firs is often associated with root disease.

Fir Engraver, *Scolytus ventralis*
Host: White fir

Regionwide, we have attributed 63,550 acres of damage to fir engraver. Significant activity occurred generally throughout the region, with the largest outbreaks on the Lincoln and Gila National Forests in southern New Mexico. Urban-interface areas near Ruidoso have experienced high (and increasing) levels of activity the past 3 years.

Western balsam bark beetle, *Dryocoetes confusus*
Hosts: Subalpine/corkbark fir

Regionwide, we have attributed 6,960 acres of damage to western balsam bark beetle. The majority of this was in New Mexico (which has the greater share of the host type); however, activity was generally widespread in the spruce-fir forests of both states. Relatively little ground checking was conducted in this forest type (to distinguish spruce mortality from fir mortality); most likely this is a very conservative estimate of damage from this insect.

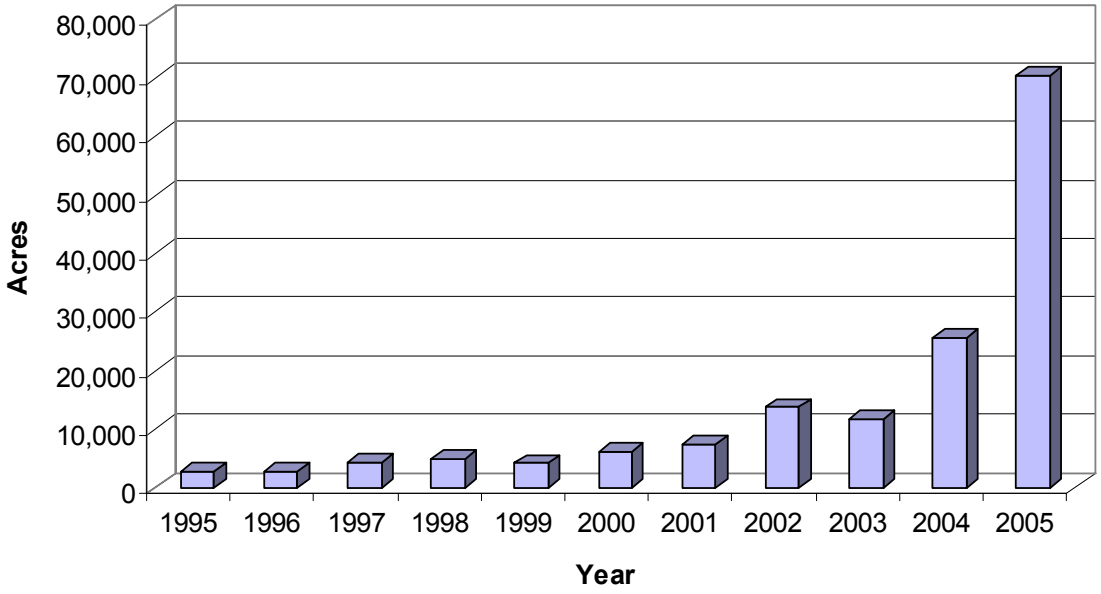

Figure 6. Fir engraver and western balsam bark beetle activity in Arizona and New Mexico, 1995 – 2005.

Spruce Beetle

Dendroctonus rufipennis
Host: Spruce

Tree mortality attributed to spruce beetle was mapped on about 20,000 acres in 2005, compared to about 21,000 acres in 2004. Most of this damage occurred in the Sangre de Cristo Mountains of New Mexico and Arizona's White Mountains. Overall, reported activity decreased in Arizona and increased slightly in New Mexico in 2005.

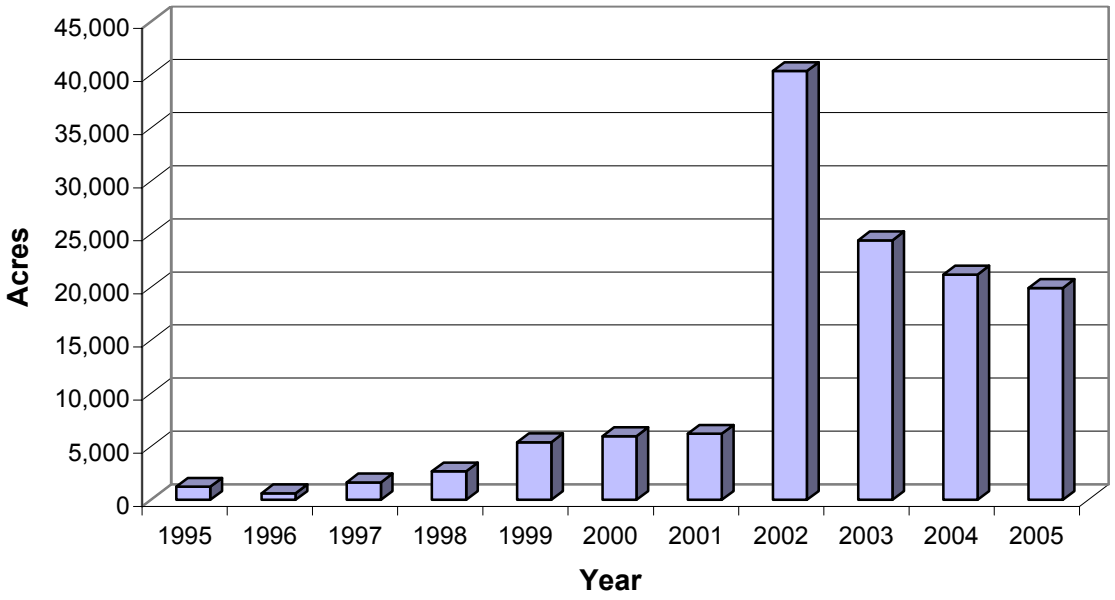

Figure 7. Spruce beetle activity in Arizona and New Mexico, 1995 – 2005.

Summary by Major Forest Types

Figure 8. White fir mortality in wildland-urban interface near Ruidoso, NM.

Ponderosa pine: Regionwide, ponderosa pine mortality continued to decrease sharply, with about 32,000 acres mapped in 2005, compared to 143,000 acres in 2004, and 763,000 acres in 2003.

Mixed conifer: Over the past 2 to 3 years, mixed conifer forests have experienced high levels of tree mortality (possibly the most ever recorded), affecting both Douglas-fir and white fir. In some areas, the bulk of the mortality has been of a single species, e.g., white fir throughout much of southern New Mexico, Douglas-fir in portions of northern New Mexico. In some areas, both species have been affected.

Comparison of 2004 and 2005 aerial survey results indicates a slight decrease regionwide in Douglas-fir beetle activity, while fir engraver activity nearly tripled. Ground checking, especially in 2005, indicates that these differences are more a result of attribution than actual changes in beetle activity. Observations indicate that fir engraver was underestimated in 2004 (and perhaps

in previous years), while Douglas-fir beetle was overestimated. It appears that activity of both species increased regionwide in 2005.

A good overall measure of damage in the mixed-conifer type is derived by combining the areas mapped for both species. This indicates an increase in total acreage affected from about 111,000 acres in 2004 to about 141,000 acres in 2005. Note that the 2004 figure assumes that 10 percent of the acreage reported as "true fir beetle" was western balsam bark beetle (in the spruce-fir type), similar to the estimate determined for 2005.

Spruce-fir: Regionwide, damage in this type changed little between 2004 and 2005, but remained relatively high, with about 27,000 acres affected. Additional ground checking could provide better estimates of the relative amounts of spruce and fir involved. Past observations indicate that spruce mortality has been overestimated and corkbark/subalpine fir mortality underestimated in some areas, especially in New Mexico.

Figure 9. Corkbark fir mortality in the Sandia Mountains.

Defoliators

Western Spruce Budworm

Choristoneura occidentalis
Hosts: True firs, Douglas-fir, spruce

Regionwide, budworm activity decreased slightly in 2005, with about 195,000 acres of defoliation detected vs. 249,000 acres the previous year. As usual, the bulk of the activity occurred in higher-elevation forests of northern New Mexico, where budworm has remained chronic for many years. Significant activity also continued on Navajo tribal lands (Chuska Mountains) in both states.

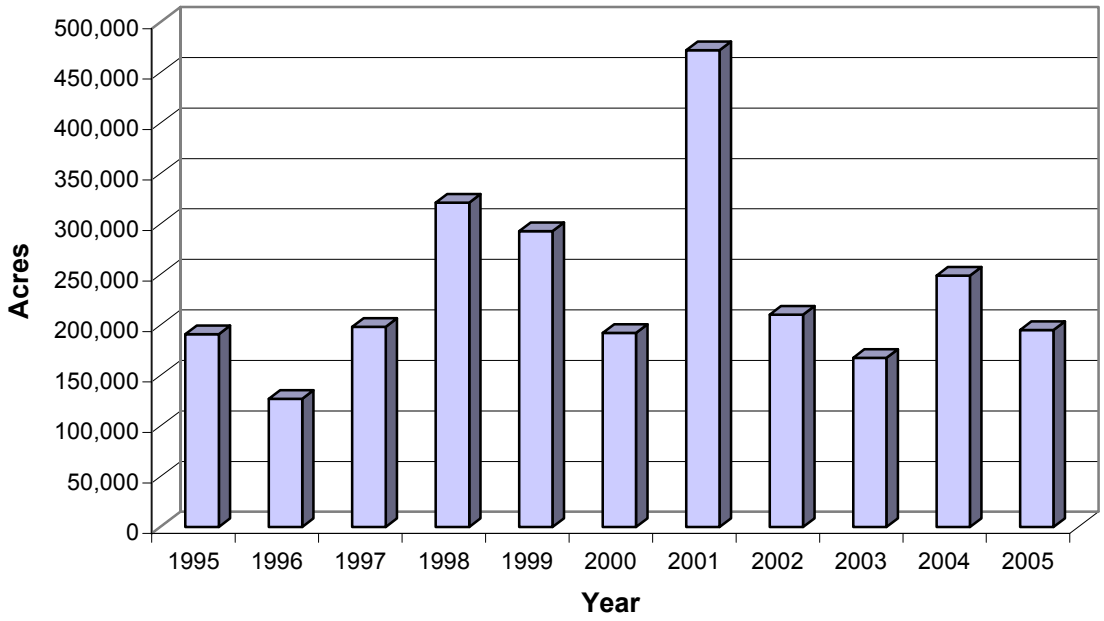

Figure 10. Western spruce budworm activity in Arizona and New Mexico, 1995 – 2005.

Douglas-fir Tussock Moth

Orgyia pseudotsugata
Hosts: White fir, Douglas-fir, spruce

A Douglas-fir tussock moth outbreak in the Sandia Mountains expanded in 2005. New defoliation was observed on 870 acres; cumulatively, the outbreak has affected 940 areas since 2004. The majority of the outbreak is in the upper portion of Pino Canyon with smaller affected areas in Domingo Baca and Bear Canyons. Evaluation of the activity in Pino Canyon during late summer and fall of 2005 revealed that many caterpillars and pupae were being affected by a virus and several parasites. Based upon these observations, the outbreak on the west side of the Sandia Mountains will probably subside in 2006. Caterpillars, cocoons, egg masses and adult moths have also been collected at several recreation sites along the Crest Highway on the east side of the Sandias. These collections suggest that tussock moth activity could cause visible defoliation on the east side of the mountain in 2006.

Figure 11. Douglas-fir tussock moth caterpillars killed by a virus.

New Mexico Fir Looper

Galenara consimilus
Hosts: Douglas-fir and white fir

A substantial outbreak has been ongoing in southern portions of the Sacramento Mountains since 2002. Area affected in 2005 (5,295 acres) was similar to that recorded the previous year (5,915 acres). This insect has caused almost complete defoliation in some areas, resulting in significant tree mortality.

Figure 12. New Mexico fir looper damage.

Spruce Aphid

Elatobium abietinum
Host: Spruce

Activity was low in 2005, with only 185 acres of defoliation detected, all in the White Mountains of Arizona.

Ponderosa Pine Needle Miner

Coleotechnites ponderosae

No needle miner activity was detected by aerial survey in Arizona or New Mexico in 2005. However, low levels of activity were observed from ground at several locations in Arizona.

Piñon Needle Scale

Matsucoccus acalyptus

Scale is a chronic defoliator of piñon at several locations in the woodlands of Arizona and New Mexico. Relatively little damage was observed in 2005.

Aspen Dieback/Defoliation

Weather-related Damage
Western Tent Caterpillar, *Malacosoma californicum*
Other insects and diseases

Aspen damage was detected on about 83,000 acres in 2005, an increase from 67,000 acres reported in 2004. In Arizona, much of the damage, which includes dieback and mortality, is a continuing problem related to the severe drought of recent years. An upswing in western tent caterpillar activity was also reported in that state. In New Mexico, most of the damage was attributed to tent caterpillar. An extensive outbreak of leafrollers, probably the large aspen tortrix (*Choristoneura conflictana*), was also observed in portions of northern New Mexico.

In general, a well-documented decrease in aspen cover type over the last several decades is a direct result of fire-exclusion. In addition, browsing by ungulates has had a deleterious effect on aspen regeneration in many parts of the region.

Status of Diseases

Mistletoes

Dwarf Mistletoes

Arceuthobium spp.
Hosts: Most conifers, especially pines and Douglas-fir

Dwarf mistletoes are the most widespread and damaging forest pathogens (disease-causing organisms) in the Southwest. There are eight species in the region, each with a different primary tree host. Three species—those affecting ponderosa pine, piñon, and Douglas-fir—are found throughout most of the ranges of their respective hosts, while the other species have more limited distributions. Regionally, over one-third of the ponderosa pine type, and up to one-half of the mixed conifer type, has some level of infection.

Figure 13. Douglas-firs with severe dwarf mistletoe infection.

Dwarf mistletoes are considered to be pathogens of trees because of their damaging effects—growth reduction, distortion (i.e. witches' brooms), and decreased longevity. Essentially, they re-allocate growth to infected portions of the tree at the expense of the rest of the tree. Severe infection can kill trees directly or predispose them to other agents, especially bark beetles. Trees of all size classes are affected by mistletoe; effects on regeneration can be substantial.

Regionwide, dwarf mistletoes cause an estimated 25 million cubic foot loss in timber production annually. In most years, dwarf mistletoe infestation represents far more loss to timber resources in the Southwest than do insects. Extensive dwarf mistletoe infestation also increases overall forest flammability. On the other hand, as a natural part of the forest, dwarf mistletoes have an ecological role and benefit some species.

On both the stand and landscape level, the distribution of dwarf mistletoes is usually patchy, with more or less discrete infection centers surrounded by areas without the disease. Infection centers expand very slowly, and overall incidence changes little from year to year. Thus, infestation is best described as a chronic situation rather than an outbreak or epidemic. However, because of fire suppression and selective cutting, the overall incidence of dwarf mistletoes has probably increased over the past century.

True Mistletoes

Phoradendron spp.
Hosts: Junipers, various hardwoods

Several species of true mistletoe occur in the Southwest. *P. juniperinum* on juniper is probably the most widespread and abundant mistletoe (true or dwarf) in the region. Mistletoes are especially common on oaks in southern portions of the region and are locally abundant in desert woodlands and lower elevation riparian areas. Heavy infection contributes toward host mortality, especially during periods of drought.

A small population of desert mistletoe (*P. californicum*) at Granite Gap in southwestern New Mexico, previously reported as extirpated following winter injury (Hubbard 1981), was observed in 2005.

Figure 14. Juniper mistletoe, with mature fruit.

Root Diseases

Root diseases are often associated with mortality attributed to bark beetles and other agents. They can also predispose trees to windthrow, an obvious concern in campgrounds and other heavily-used areas. Root diseases are generally more common in mixed conifer and spruce-fir forests than in ponderosa pine forests. Like dwarf mistletoes, root diseases spread slowly, so overall incidence changes little year to year. Root diseases are often described as "diseases of the site," and can be exacerbated by certain activities.

Armillaria Root Disease

Armillaria spp.
Hosts: Most conifers, aspen

Armillaria is the most common root disease in the Southwest and may account for up to 80 percent of the root disease-associated mortality in the region. All size classes can be affected. Previous surveys on the North Kaibab Ranger District found the fungus on about 30 percent of the standing live trees. In addition to causing disease, the fungus is a common decayer of dead woody material (a saprophyte).

Annosus Root Disease

Heterobasidion annosum
Hosts: Most conifers

Annosus root disease is probably the second most common root disease in the Southwest. It is found most often on true firs, although most conifers are susceptible. All size classes can be affected. Like *Armillaria*, *Heterobasidion* is a common decayer of dead woody material as well as a pathogen.

Other common root diseases…

in the Southwest include **Schweinitzii root/butt rot**, *Phaeolus schweinitzii*, often found on older Douglas-fir and occasionally ponderosa pine; **Tomentosus root/butt rot**, *Inonotus tomentosus,* on spruce; and **Ganoderma butt rot**, *Ganoderma applanatum*, found in many aspen stands. **Black Stain root disease**, *Leptographium wageneri,* appears to be rare in the Southwest.

Stem Decays

Figure 15. *Inonotus dryophilus*, a heartrot of oak

Stem decays are common in older trees throughout the region. Decay represents an economic loss in terms of timber production and can increase hazard on developed sites. On the other hand, decayed trees provide important habitat for many wildlife species, particularly cavity nesters. The most common stem decays in the Southwest include **red rot**, *Dichomitus squalens*, of ponderosa pine; **red ring rot**, *Phellinus pini,* affecting most conifers; **rust-red stringy rot**, *Echinodontium tinctorium*, on white fir; **aspen trunk rot**, *Phellinus tremulae*; and *Inonotus dryophilus* on oak.

Aspen Stem Cankers

The soft, living bark of aspen is highly susceptible to canker-causing fungi. One or more of these diseases are common in most aspen stands. The most common include **sooty bark canker**, *Encoelia pruinosa*; **black canker**, *Ceratocystis fimbriata*; **Cryptosphaeria canker**, *Cryptosphaeria populina*; and **Cytospora canker**, *Cytospora chrysosperma*. Cankers are one of the main reasons that aspen is a relatively short-lived tree.

Stem Rusts

White Pine Blister Rust

Cronartium ribicola
Host: Southwestern white pine

Blister rust occurs throughout most of the range of southwestern white pine in the Sacramento Mountains, the adjoining White Mountains, and the nearby Capitan Mountains of southern New Mexico. This area probably contains the largest population of white pines in the region and more than 40 percent of them are currently infected, based on a set of representative plots. The disease also occurs on Gallinas Peak, about 80 miles north of the main outbreak area.

In 2005, blister rust was detected for the first time on the Gila National Forest. Surveys are planned in 2006 to determine the extent of the outbreak in that area.

Figure 16. Southwestern white pine with blister rust.

Broom Rust

Melampsorella caryophyllacearum
Host: True firs

Chrysomyxa arctostaphyli
Host: Spruces

Broom rusts are found at low levels throughout much of the ranges of their hosts in the Southwest. High concentrations of fir broom rust occur in the Sandia and Manzano Mountains of central New Mexico and at a few other locations. Damage from these easily recognized diseases has not been well quantified; however, infection can result in topkill, particularly in spruce. Occasionally, falling brooms or stem breakage at the point of infection present a hazard.

Figure 17. Fir broom rust infection.

Limb Rust

Cronartium arizonicum
Host: Ponderosa pine

This disease is fairly common in parts of Arizona and can be quite damaging to individual trees. The fungus causes progressive branch mortality, usually from the center of the crown. Waves of new infection typically occur at intervals of several years. This disease is uncommon in New Mexico.

Comandra Blister Rust

Cronartium comandrae
Host: Pines

This disease has caused extensive branch dieback and mortality of nonnative Mondell/Afghan pine (*Pinus eldarica*) in the Prescott, Payson, and Sedona areas of central Arizona. It occasionally infects native ponderosa pines in this area, but has caused minimal damage to this species.

Western Gall Rust

Peridermium (Endocronartium) harknessii
Host: Pines

This is an occasional disease of ponderosa pine in the Southwest, where it is usually found as the white-spored form, rather than the orange-spored form.

Foliage Diseases

Sycamore Anthracnose

Apiognomonia venata

Although damage was less severe than in 2004, Arizona sycamore was affected along several riparian areas in central Arizona in May of 2005. Fungal spore dispersal was aided by a short period of wet, cool spring conditions. The disease occurs in three phases: bud and twig formation, shoot blight, and leaf blight. New leaves and shoots emerge from previously dormant buds within a month.

Ponderosa Pine Needle Cast

Lophodermella cerina and other species

No needle cast activity was detected in 2005.

Abiotic Damage

Drought

Discoloration of ponderosa pine attributed to drought was mapped on about 18,000 acres in Arizona in 2005, the majority on the Coconino National Forest.

Hail

Nearly 1,000 acres of ponderosa pine were heavily damaged by hail on the Coconino National Forest. Needles and branches in the upper crowns were broken off and remaining branches were scarred.

Miscellaneous Pests

Tiger moth (*Lophocampa ingens*) activity was high throughout much of the region during late winter and spring of 2005. Tents were frequently observed in the tops of ponderosa pine, piñon, southwestern white pine, and other conifers.

Landscape pines in New Mexico, especially ponderosa, continued to be damaged by several **tip moth** species (genus *Rhyacionia*).

Figure 18. Tiger moth webbing and damage.

Twig beetles, very damaging to piñons during the recent drought years, were much less active in 2005.

Fall webworm (*Hyphantria cunea*) was common in landscape and lower elevation riparian hardwoods, especially cottonwoods.

American hornet moth (*Sessia tibialis*) has been damaging aspens in Arizona's urban landscapes. Larval feeding in the root crown destroys vascular tissue, often reducing stability and leading to windthrow.

Another common insect affecting aspens in these settings has been **oystershell scale** (*Lepidosaphes ulmi*). These feed on phloem of mature trees and can cause mortality if left unchecked.

Diseases damaging aspen in Flagstaff's urban landscape include **Cryptosphaeria canker**.

Some unusual defoliators were seen this year on sycamores in southeastern Arizona. **Lace bugs** (*Corythucha confraterna*), observed on the Apache-Sitgreaves National Forest, caused a bronze discoloration of affected crowns. **Leaf hoppers** (family *Cicadellidae*), seen on the Coronado National Forest, caused a yellowing of the crowns.

Cypress bark beetles (*Phloesinus* spp.) continued to damage Arizona cypress in some locations, but with improved moisture activity was much less in 2005 than in previous years. Previous damage had significantly reduced the amount of susceptible host in some areas.

Yellow-shafted flicker (sapsucker) damage was very common on many tree species throughout northern Arizona.

Porcupine, elk, and deer caused excessive damage to young landscape trees of many species in Arizona.

Biological Evaluations and Technical Assistance

Arizona Zone

1. Evaluation of bark beetle activity in and around the Nixon Administrative Center; 4/25/05.
2. Evaluation of desert mistletoe infection at Sabino Canyon Visitor Center and Santa Catalina RD Office; 4/14/05.
3. Insect activity at Canyon de Chelly National Monument; 6/22/05.
4. Evaluation of salt toxicity of ponderosa pine along State Highway 260, Black Mesa RD, Apache-Sitgreaves NF; 8/08/05.
5. Priest Draw Aspen Restoration; 8/23/05.
6. Douglas-fir beetle activity on the San Francisco Peaks; 8/25/05.
7. Post treatment evaluation for bark beetles, Pinaleño Mt., Safford RD, Coronado NF; 10/12/05.
8. Evaluation of Arizona cypress mortality in Chiricahua National Monument; 10/18/05.
9. Bark beetle activity in recreation sites on the Black Mesa RD, Apache-Sitgreaves NF; 10/24/05.
10. Spruce Beetle at Snowbowl Ski Area; 10/24/05.
11. Proposed 2006 Williams follow-up mistletoe treatments, Williams RD; 10/25/05.
12. Evaluation of FY2006 Malay Gap dwarf mistletoe suppression project, San Carlos Apache Reservation; 10/26/05.
13. Douglas-fir beetle activity in Mexican spotted owl PAC sites within the Rodeo-Chediski Fire; 11/01/05.
14. Chitty Creek forest health restoration project; 11/01/05.
15. Bark beetle activity in Bald Mesa Wildland-Urban Interface Project area; 11/01/05.
16. Bark beetle activity in forest health restoration projects on the Williams RD; 11/01/05.
17. Proposed 2006 Pinaleño Mountains wildland-urban interface hazardous fuels project, Safford RD; 11/01/05.
18. Proposed 2006 Willow Ridge restoration project, Santa Catalina RD; 11/03/05.
19. Proposed 2006 Pinaleño ecosystem management restoration project, Safford RD; 11/03/05.
20. Evaluation of insects and diseases affecting CEEMS certification stand; 11/08/05.

New Mexico Zone

1. Cottonwood decline and mortality, San Ildefonso Pueblo; 2/4/05.
2. Bark beetle management considerations for pasture-restoration treatment, Pecos National Historic Park; 3/21/05.
3. Insect and disease conditions and silvicultural recommendations, El Rito Ranger District, Carson National Forest; 5/9/05.
4. Two-year follow-up on Paliza Campgrounds Bark Beetle Prevention Project, Jemez Ranger District, Santa Fe National Forest; 5/10/05.
5. Tiger moth activity at Mora Research Center, Mora, New Mexico; 5/9/05.
6. Monument Canyon bark beetle preventative thinning, Jemez Ranger District, Santa Fe National Forest; 6/2/05.
7. Insect activity in Encebado Burn area, Taos Pueblo; 6/20/05.
8. Follow-up visit to pasture-restoration treatment, Pecos National Historical Park; 6/22/05.
9. Proposed FY 2006 dwarf mistletoe control/thinning project, Jicarilla Apache Indian Reservation; 7/8/05.
10. Proposed FY 2006 dwarf mistletoe suppression project, Mescalero Apache Indian Reservation; 8/1/05.
11. Proposed FY 2006 dwarf mistletoe control/thinning project, Picuris Pueblo; 8/1/05.
12. Western tent caterpillar defoliation at the Canjilon Lakes Recreation Area, Canjilon Ranger District, Carson National Forest; 8/11/05.
13. Douglas-fir tussock moth activity in the Sandia Mountains, Sandia Ranger District, Cibola National Forest; 8/18/05.
14. Potential FY 2006 insect and disease prevention/suppression projects, Reserve Ranger District, Gila National Forest; 8/24/05.
15. Potential insect and disease prevention/suppression projects, Glenwood Ranger District, Gila National Forest; 8/24/05.
16. Proposed FY 2006 Walker dwarf mistletoe suppression project, Sacramento Ranger District, Lincoln National Forest; 9/17/05.
17. Potential FY 2006 insect and disease prevention/suppression project in La Cueva fuelbreak, Pecos Ranger District, Santa Fe National Forest; 9/23/05.
18. Potential insect and disease prevention/suppression project in Ruidoso WUI, Smokey Bear Ranger District, Lincoln National Forest; 9/28/05.
19. Potential FY 2006 insect and disease prevention/suppression projects, Cuba, Coyote, and Jemez Ranger Districts, Santa Fe National Forest; 10/5/05.

20. Proposed FY 2006 Puertecito insect and disease prevention/suppression project, El Rito Ranger District, Carson National Forest; 10/12/05.

Publications

John C. Moser, Bobbe A. Fitzgibbon and Kier Klepzig. **The Mexican pine beetle, *Dendroctonus mexicanus*: first recorded in the United States and co-occurrence with the southern pine beetle - *Dendroctonus frontalis* (Coleoptera: Curculionidae: Scolytinae)**; Entomological News, Volume 116, Number 4, September and October 2005, 235-243.

Visit Us Online

In an effort to better serve the Internet user, we continue to expand our online information base. The Forest Service Southwestern Region hosts a Forest Health Web site at http://www.fs.fed.us/r3/resources/health. Technical information posted on this site includes annual forest insect and disease conditions reports, literature on pest biology and management, and general information on forest health in the Southwest. Additionally, our Forest Health Protection national office maintains a Web site at http://www.fs.fed.us/foresthealth/ which includes program overviews and publications links.

Appendix

Instructions for Submitting Insect and Disease Specimens for Identification

Both zone offices are equipped to receive forest insect or disease specimens submitted from the field for identification. Specimens may be shipped to the appropriate zone office as listed on the title page of this report. The following procedures for collecting and shipping specimens should be used.

Collecting

1. Adequate material should be collected

2. Adequate information should be recorded, including:

    a. location of collection
    b. when collected
    c. who collected the specimen
    d. host description (species, age, condition, etc.)
    e. area description (forest type, site conditions, etc.)
    f. unusual conditions (frost, poor drainage, etc.)

3. Personal opinion of the cause of the problem may be helpful.

Packing

1. **Larvae and other soft-bodied insects** should be shipped in small screw-top vials or bottles containing at least 70 percent isopropyl (rubbing) alcohol. Use only enough alcohol to fully immerse the specimens; shipping regulations limit the amount to 30 ml (2 tablespoons or about 1 ounce) per vial. Make sure lids are well-sealed. Place all vials in a sealed plastic bag, using packing materials between vials to minimize movement. Ship in sturdy box.

2. **Pupae and hard-bodied insects** may be shipped either in alcohol or in small boxes. Specimens should be placed between layers of tissue paper in the boxes. Pack carefully and make sure there is little movement of material within the box. Do not pack insects in cotton.

3. **Needle or foliage diseases**: Do not ship in plastic bags as condensation can become a problem. Use a paper bag or wrap in newspaper. Pack carefully and make sure there is little movement within the box.

4. **Mushrooms and conks**: Do not ship in plastic bags. Either pack and ship immediately or air-dry and pack. To pack, wrap specimens in newspaper and pack into a shipping box with more newspaper. If on wood, include some of the decayed wood.